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AMERICAN SAMOA PURSE SEINE FISHERY SAMPLING

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ADMINISTRATIVE REPORT H-88-20

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PREFACE

This report updates and expands a previous version, which was confidential, by Victor A. Honda, Gordon S. Yamasaki, and Russell Y. Ito. Confidential data have been removed from this report. Ito, a biological technician with the Honolulu Laboratory, prepared this report. Honda currently works for the Southwest Enforcement office of the National Marine Fisheries Service, NOAA, and Yamasaki currently works for the Southwest Region, National Marine Fisheries Service, NOAA.

Southwest Fisheries Center Administrative Report H-88-20

AMERICAN SAMOA PURSE SEINE FISHERY SAMPLING

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INTRODUCTION

Although tunas have long been important traditional fisheries for Pacific islanders, it was the expansion of distant water fishing fleets into the South Pacific since 1960 that initiated scientific sampling of these catches by the Bureau of Commercial Fisheries (now the National Marine Fisheries Service (NMFS)). The NMFS began monitoring the foreign longline tuna landings in late 1962. A NMFS field station was established in 1963 in Pago Pago, American Samoa, from which more intensive sampling of the longline catch was conducted. The NMFS field station has been sampling the purse seine catches since 1970.

Since 1970, U.S. purse seiners have been off-loading tuna in American Samoa. Some of the U.S. catch is also transshipped to American Samoa. The western Pacific purse seine fishery expanded dramatically during the 1980's. This expansion shifted American Samoan tuna canneries from processing low volumes of fancy white-meat canned tuna to processing high volumes of light-meat tuna (Schug and Galea'i 1987). Though the purse seine fishery in the South Pacific region is very active, the number of U.S. vessels has decreased because of vessels being transferred to foreign flags (Doulman 1987) or sold to foreign countries. However, most of the vessels still operate in the western Pacific.

With the South Pacific Tuna Treaty, concerning access rights and data reporting in the South Pacific Exclusive Economic Zones, a new sampling protocol will begin. This report presents information on the U.S. purse seine fishery off-loading in or transshipping their catch to American Samoa during the period 1980 through 1986.

SOURCES OF DATA

The NMFS data collection methodologies presented in this report were in place in American Samoa prior to the implementation of the South Pacific Tuna Treaty in June 1988. Data from purse seiners and transshipment vessels were obtained from direct interviews with vessel operators, landing reports issued by the canneries, and length measurements taken by NMFS biologists for tuna caught by purse seiners. Before the treaty, daily fishing logs were not collected from purse seiners off-loading in American Samoa. Some of the data collected are confidential and are not included in this report.

Upon the arrival of a purse seiner in American Samoa, a NMFS biologist interviewed the captain to gather general operational data, such as the number of fishing days, area fished, and species composition of the catch. Although fishing area is requested in terms of the Food and Agriculture Organization (FAO) of the United Nations fishing area codes (Fig. 1), information on fishing areas was often general and sometimes not given. We designated an area as 71 in 1985 because some data received did not indicate whether the vessel fished in areas 71A or 71B. Similarly, an area was designated as 77 in 1986 when data did not indicate whether the vessel fished in area 77A or 77B. Information on purse seiners transshipping their

catch to American Samoa is obtained from the cannery fleet office or carrier vessel.

The source of the data on landings for tuna caught by purse seiners in the western Pacific Ocean was derived from confidential information voluntarily provided by the tuna canneries in American Samoa (Star-Kist Samoa, Inc. and Samoa Packing Co.) and also obtained by direct interviews at the time of off-loading. The information was voluntarily supplied, and only a small percentage of the vessels declined to furnish NMFS with data.

Permission was necessary from the owner, captain, or navigator before any length-frequency measurements were taken. A sample of 50 skipjack tuna, *Katsuwonus pelamis*, and 50 fish of the yellowfin tuna, *Thunnus albacares*, and bigeye tuna, *T. obesus*, category were randomly selected from each fishhold of the purse seiners sampled. These fish were measured for fork length (FL) to the nearest millimeter. The number of fishholds per purse seiner ranged from 15 to 24, and the carrying capacity of each fishhold ranged from 35 to 110 metric tons (t).

Fish were manually removed from the fishholds and placed in metal fish containers (1.0 × 1.0 × 1.5 m). Each container was winched out of the well and off-loaded by crane onto the dock, weighed, and either put in freezers or processed. The length-frequency sampling occurred on the dock prior to the containers being transported to the freezer or processed.

Five fish per container were randomly selected and measured until a total of 50 samples were obtained from each fishhold. Ten fish per container were measured when off-loading operations were slow or the total number of fish in the fishhold was <50 fish. Less than five fish were sampled if the fish boxes contained large yellowfin or bigeye tuna or if off-loading conditions became hazardous. Some selectivity in sampling was unavoidable. Damaged or misshapen fish or fish with broken tails were not measured. Unloading procedures at the canneries also contributed to selectivity because stevedores sometimes sorted fish by size and species. Date of sampling, name of vessel, departure and arrival dates, and location of fishing grounds were also obtained. Length-frequency measurements were not taken from transshipment vessels.

Data were edited and processed at the NMFS Honolulu Laboratory.

RESULTS

Fishing Effort

Information on vessels was summarized by the number of purse seiners and transshipment vessels, purse seiners by carrying capacity, and the combined carrying capacity of the purse seiners. Trip activity was monitored by the number of off-loadings made annually. Also, when the information was available, the number of trips by FAO fishing area was summarized.

The purse seine fleet had increased in number from 4 vessels fishing in 1980 to 35 vessels in 1984 (Fig. 2). In 1985, the number of vessels decreased slightly to 31 vessels. Thirty vessels fished in 1986. Transshipment vessels, on the other hand, decreased from 13 vessels in 1980 to 2 vessels in 1983 (Fig. 2). The number of transshipment vessels then rose to a high of 14 vessels in 1986.

Most of the purse seiners had a carrying capacity of 1,200 short tons,[1] with a few smaller and larger vessels operating in the fishery (Table 1). The combined carrying capacity of four purse seiners in 1980 was 5,275 short tons (4,784 t) (Fig. 3). The combined carrying capacity of 35 purse seiners in 1984 was 41,695 short tons (37,817 t) and of 30 vessels in 1986 was 37,025 short tons (33,582 t).

The number of trips made by purse seiners increased from 5 trips in 1980 to 89 trips in 1983 (Fig. 4). Trips then decreased to 60 in 1985 but increased to 87 in 1986. With the exception of 1980, each purse seiner averaged about two to three trips per year. Transshipment vessels off-loaded 55 times in 1980 and 59 times in 1981 (Fig. 4). Since then, the number of off-loadings has ranged from 12 in 1982-83 to 19 in 1984. Information on number of trips by area fished was incomplete (from 80% in 1981 to 8% in 1985), but most of the fishing activity occurred in areas 71A and 71B (Table 2). A few trips were made in area 77B in 1982-84. One trip was made in area 77A in 1986.

Landings

The confidential nature of the landings data necessitates using an index of landings for displaying data. Though the index of landings does not indicate the weight of fish caught by purse seiners, it does show the relative change in landings. In 1980, the total landings and average catch per trip were given a value of 100. The subsequent years were scaled accordingly. Tuna off-loaded by purse seiners and transshipment vessels were combined to obtain an index of total landings and species compositon.

The index of total landings increased steadily from 1980 through 1986 (Fig. 5). The only year in which landings decreased was 1982. The index of landings increased over sixfold during the 7-year period. The only year in which transshipment vessels off-loaded more tuna than did purse seiners (83% to 17%, respectively) was 1980 (Fig. 6). Since then, purse seiners off-loaded from 64% (1985) to 95% (1982-83) of the tuna caught.

The three major species of fish caught by purse seiners were skipjack, yellowfin, and bigeye tunas, and few or no incidental catches were off-loaded. The species composition of landings were grouped into three categories: 1) skipjack tuna, 2) yellowfin-bigeye tunas, and others (albacore, *Thunnus alalunga*; billfishes; and other miscellaneous species).

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[1]Industry standard is in short tons; 1 short ton = 0.907 t.

The percentage of skipjack tuna caught equaled 70% in 1980 and decreased to 61% in 1981 (Fig. 7). Skipjack tuna composition increased to 77% in 1985 and decreased slightly to 70% in 1986. The yellowfin-bigeye category ranged from 23% in 1985 to 37.3% in 1981. The "others" category ranged from 0% in 1982-84 to 5% in 1980.

Data on the area of capture was incomplete, so the percentage of landings and species composition by area may not correspond precisely to the index of annual landings and species composition. In 1981-86, most of the purse seiner catches occurred in areas 71A and 71B (62 to 100% for both areas combined) (Table 3). Some catches were made in area 77B during 1982-84 (10 to 38%), and very little seining occurred in area 77A during 1986 (3%). The composition of skipjack tuna was higher than the composition of yellowfin and bigeye tunas in almost all instances (Table 4).

The index of average catch per trip increased slightly to 108 in 1981, then decreased slightly to 99 in 1982 (Fig. 8). Since then, the index of average catch per trip rose steadily to 126 in 1986. No area of capture data was available for 1980. In general, the index of average catch per trip increased in areas 71A and 71B (Table 5). There were not enough data to show any trends in catch rates for other areas.

Length-Frequency Distribution

Length-frequency measurements are summarized for skipjack, yellowfin, and bigeye tunas by date of unloading. They are presented in annual mean lengths, quarterly length-frequency histograms, and annual mean lengths by FAO areas when area of catch is available. The low percentage of fish below 45 cm FL in 1986 can be explained by the canneries' preference for larger fish. Because of yield (percent usable product) and fish cleaning time, seiners are paid on an increasing scale for larger fish. Fish under 4 lb (<45 cm FL) bring little or no compensation. As a result, many undersized fish and other species are culled before being loaded into the fishholds. Fishing strategy and trip length also can be affected by this same factor because vessels try to avoid sets on schools of small fish.

There was no significant increase or decrease in the annual mean size of skipjack, yellowfin, and bigeye tunas. The annual mean size of skipjack tuna ranged from 49.2 cm FL in 1983 to 55.0 cm FL in 1984 (Table 6). The annual mean size of yellowfin tuna ranged from 68.9 cm FL in 1981 to 83.7 cm FL in 1985 (Table 7). No length data were available for bigeye tuna previous to 1984. The annual mean size for bigeye tuna ranged from 60.8 cm FL in 1985 to 69.9 cm FL in 1984 (Table 8).

All length-frequency histograms for skipjack, yellowfin, and bigeye tunas were grouped by 3-month (quarterly) intervals. The length-frequency histograms for skipjack tuna during the 1980-86 period show a small fluctuation in size throughout the year, with most fish in the 45 to 55 cm FL size class (Figs. 9-13). There was no pattern in mean size of fish measured throughout the year. The fluctuation in size of yellowfin tuna was much greater, with shifts in size throughout the year (Figs. 14-18). Some

of the histograms show two distinct modes. The variation in size of bigeye tuna was not as great as for yellowfin tuna, but there were some instances of two modes in some quarters (Figs. 19-21). Again, there was no pattern in the seasonality of large fish present in any particular quarter of the year.

No increase or decrease in mean fork lengths was apparent in any particular FAO fishing area in which skipjack, yellowfin, or bigeye tuna were captured during 1981-86 (Tables 9-11). Also, mean sizes of fish from different areas did not vary much.

CONCLUSION

The activity of and landings by the U.S. purse seine fleet fishing in the South Pacific Ocean has increased rapidly in the 1980's. The length measurements of tuna caught by purse seiners indicate no declining trends in size. The continuation and expansion of the sampling program will help assess the impact of the western Pacific purse seine fishery based in American Samoa.

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Table 1.--Number of purse seiners by carrying capacity (in short tons[a]), 1980-86.

Year	Vessels (No.) by carrying capacity						Total No. vessels
	1,000	1,100	1,200	1,300	1,400	≥1,500	
1980	1	0	2	0	0	1	4
1981[b]	1	1	10	0	2	3	17
1982[b]	1	1	13	0	3	3	21
1983	1	2	22	0	3	3	31
1984	2	3	26	0	2	2	35
1985	2	3	20	0	2	4	31
1986	1	3	20	0	4	2	30

[a]One short ton = 0.907 metric ton.
[b]One vessel was not included because data were not available.

Table 2.--Number of trips, by Food and Agriculture Organization of the United Nations area, of U.S. purse seiners in American Samoa, 1981-86.[a]

Year	Trips (No.)/area						Total
	71A	71B	71	77A	77B	77	
1981	3	5	--	--	--	--	8
1982	1	14	--	--	6	--	21
1983	30	9	--	--	5	--	44
1984	26	20	--	--	8	--	54
1985	11	29	15	--	--	--	55
1986	31	24	8	1	--	2	66

[a]Number of trips by area fished may not add up to the annual number of trips because of nonreporting of the area of catch.

Table 3.--Percent landings reported, by Food and Agriculture Organization of the United Nations fishing areas, of U.S. purse seiners in American Samoa, 1981-86.

Year	Landings (%) by area					
	71A	71B	71	77A	77B	77
1981	67	33	--	--	--	--
1982	7	55	--	--	38	--
1983	67	23	--	--	10	--
1984	47	40	--	--	13	--
1985	19	53	28	--	--	--
1986	47	36	12	1	--	3

Table 4.--Catch composition, by Food and Agriculture Organization of the United Nations fishing areas, of U.S. purse seiners in American Samoa, 1981-86.[a]

Year	Species	Catch composition (%)[b]						
		71A	71B	71	77A	77B	77	Total[c]
1981	Skipjack tuna	37	13	--	--	--	--	50
	Yellowfin and bigeye tunas	30	20	--	--	--	--	50
1982	Skipjack tuna	4	36	--	--	26	--	66
	Yellowfin and bigeye tunas	3	19	--	--	12	--	34
1983	Skipjack tuna	47	17	--	--	7	--	71
	Yellowfin and bigeye tunas	20	6	--	--	3	--	29
1984	Skipjack tuna	38	26	--	--	10	--	74
	Yellowfin and bigeye tunas	9	14	--	--	3	--	26
1985	Skipjack tuna	15	38	22	--	--	--	75
	Yellowfin and bigeye tunas	4	15	6	--	--	--	25
1986	Skipjack tuna	34	25	9	1	--	0	69
	Yellowfin and bigeye tunas	13	11	3	0	--	3	30

[a]No data were available for 1980 or for the other species category.

[b]May not add up to the annual percentage of species composition, because of the nonreporting of the area of catch.

[c]Numbers may not total 100% because of rounding.

Table 5.--Index of average catch per trip by Food and Agriculture Organization of the United Nations fishing areas, 1981-86.[a]

Year	Area					
	71A	71B	71	77A	77B	77
1981	98	29	--	--	--	--
1982	130	77	--	--	116	--
1983	90	100	--	--	86	--
1984	105	117	--	--	94	--
1985	121	120	123	--	--	--
1986	123	122	121	121	--	139

[a]The 1980 average catch per trip equals 100.

Table 6.--Number (N), mean fork length, and standard deviation (SD) of skipjack tuna, 1981-86.

Year	N	Fork length (cm) $\bar{x}$	SD
1981	225	54.1	6.2
1982	480	50.6	9.1
1983	938	49.2	7.8
1984	10,104	55.0	5.9
1985	35,272	53.5	7.1
1986	44,592	53.6	5.4

Table 7.--Number (N), mean fork length, and standard deviation (SD) of yellowfin tuna, 1981-86.

Year	N	Fork length (cm) $\bar{x}$	SD
1981	135	68.9	17.5
1982	182	75.3	31.4
1983	1	81.0	0.0
1984	6,634	77.7	20.0
1985	18,546	83.7	30.2
1986	30,814	75.3	23.6

Table 8.--Number (N), mean fork length, and standard deviation (SD) of bigeye tuna, 1984-86.

Year	N	Fork length (cm) $\bar{x}$	SD
1984	1,573	69.9	15.7
1985	2,862	60.8	16.9
1986	4,099	61.3	10.6

Table 9.--Number (N), mean fork length (cm), and standard deviation (SD) of skipjack tuna by Food and Agriculture Organization of the United Nations fishing areas, 1981-86.

Year	Area					
	71A	71B	71	77A	77B	77
1981						
N	75	--	--	--	--	--
$\bar{x}$	52.2	--	--	--	--	--
SD	8.0	--	--	--	--	--
1982						
N	25	125	--	--	225	--
$\bar{x}$	47.8	45.9	--	--	53.4	--
SD	4.0	10.8	--	--	7.2	--
1983						
N	413	50	--	--	326	--
$\bar{x}$	52.0	53.1	--	--	44.4	--
SD	5.9	5.6	--	--	8.4	--
1984						
N	977	7,076	699	--	384	75
$\bar{x}$	52.4	55.4	56.8	--	51.5	55.9
SD	8.4	4.9	4.9	--	10.4	8.4
1985						
N	2,122	4,349	1,760	--	--	--
$\bar{x}$	55.2	51.8	53.0	--	--	--
SD	5.9	6.0	75	--	--	--
1986						
N	19,958	15,463	705	--	--	--
$\bar{x}$	51.8	50.9	--	--	--	--
SD	5.0	5.5	3.8	--	--	--

Table 10.--Number (N), mean fork length (cm), and standard deviation (SD) of yellowfin tuna by Food and Agriculture Organization of the United Nations fishing areas, 1981-86.

Year	Area					
	71A	71B	71	77A	77B	77
1981						
N	35	--	--	--	--	--
$\bar{x}$	86.3	--	--	--	--	--
SD	17.6	--	--	--	--	--
1982						
N	25	100	--	--	--	--
$\bar{x}$	58.0	69.2	--	--	--	--
SD	23.1	24.8	--	--	--	--
1983						
No Data						
1984						
N	118	5,225	613	--	--	38
$\bar{x}$	79.7	76.6	85.9	--	--	67.5
SD	22.7	19.3	16.9	--	--	11.5
1985						
N	367	2,146	810	--	--	--
$\bar{x}$	98.3	69.7	60.9	--	--	--
SD	31.6	27.3	19.5	--	--	--
1986						
N	13,001	10,498	350	--	--	--
$\bar{x}$	77.4	64.4	61.8	--	--	--
SD	18.9	18.2	14.9	--	--	--

Table 11.--Number (N), mean fork length (cm), and standard deviation (SD) of bigeye tuna by Food and Agriculture Organization of the United Nations fishing areas, 1984-86.

	Area					
Year	71A	71B	71	77A	77B	77
1984						
N	43	1,190	152	--	--	1
$\bar{x}$	66.5	69.0	73.0	--	--	84.9
SD	20.4	15.4	16.9	--	--	0.0
1985						
N	41	354	169	--	--	--
$\bar{x}$	68.9	58.8	56.7	--	--	--
SD	23.8	9.7	5.5	--	--	--
1986						
N	1,517	1,742	152	--	--	--
$\bar{x}$	64.5	57.9	57.3	--	--	--
SD	11.5	8.7	8.3	--	--	--

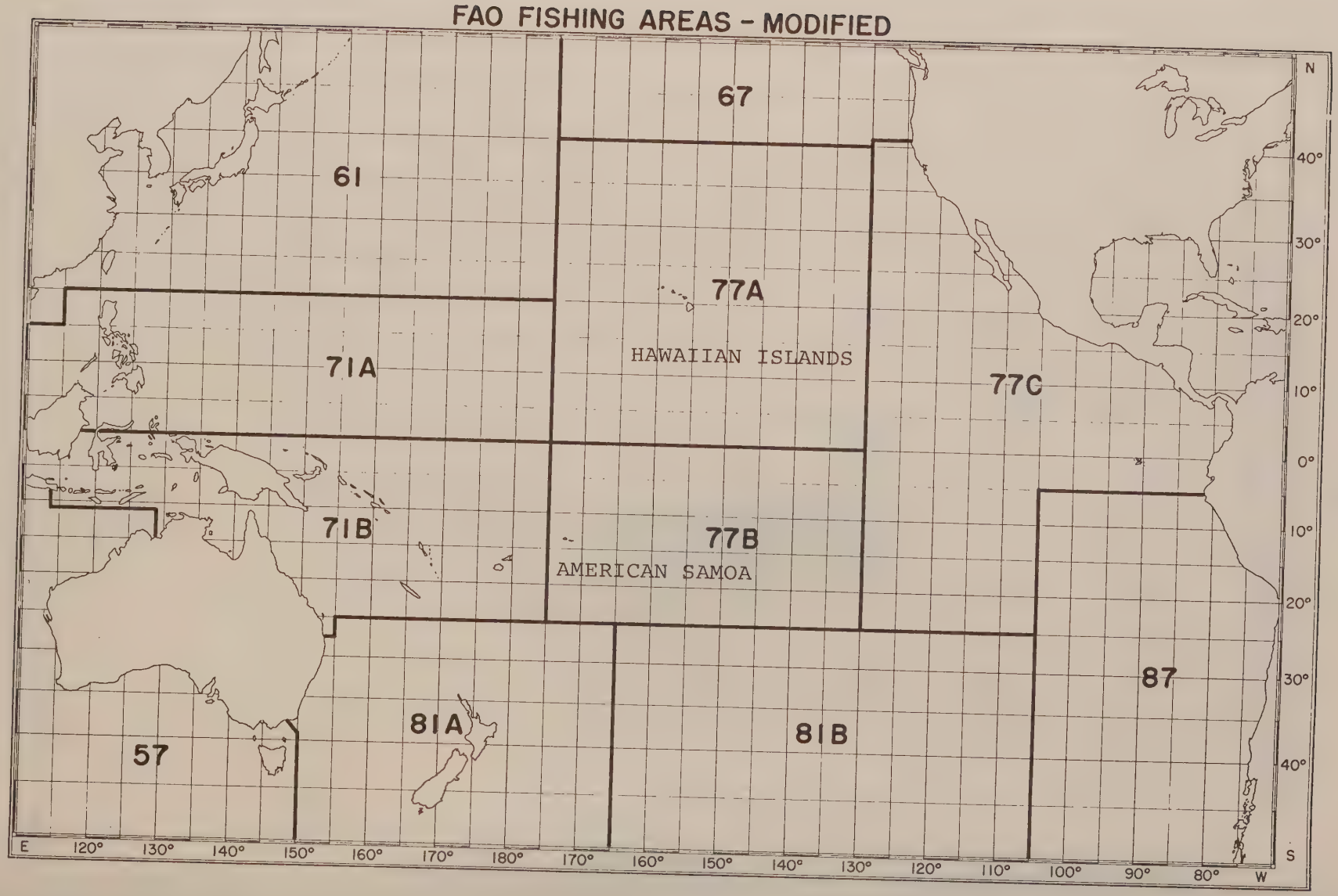


Figure 1.--The fishing areas of the Food and Agriculture Organization of the United Nations.

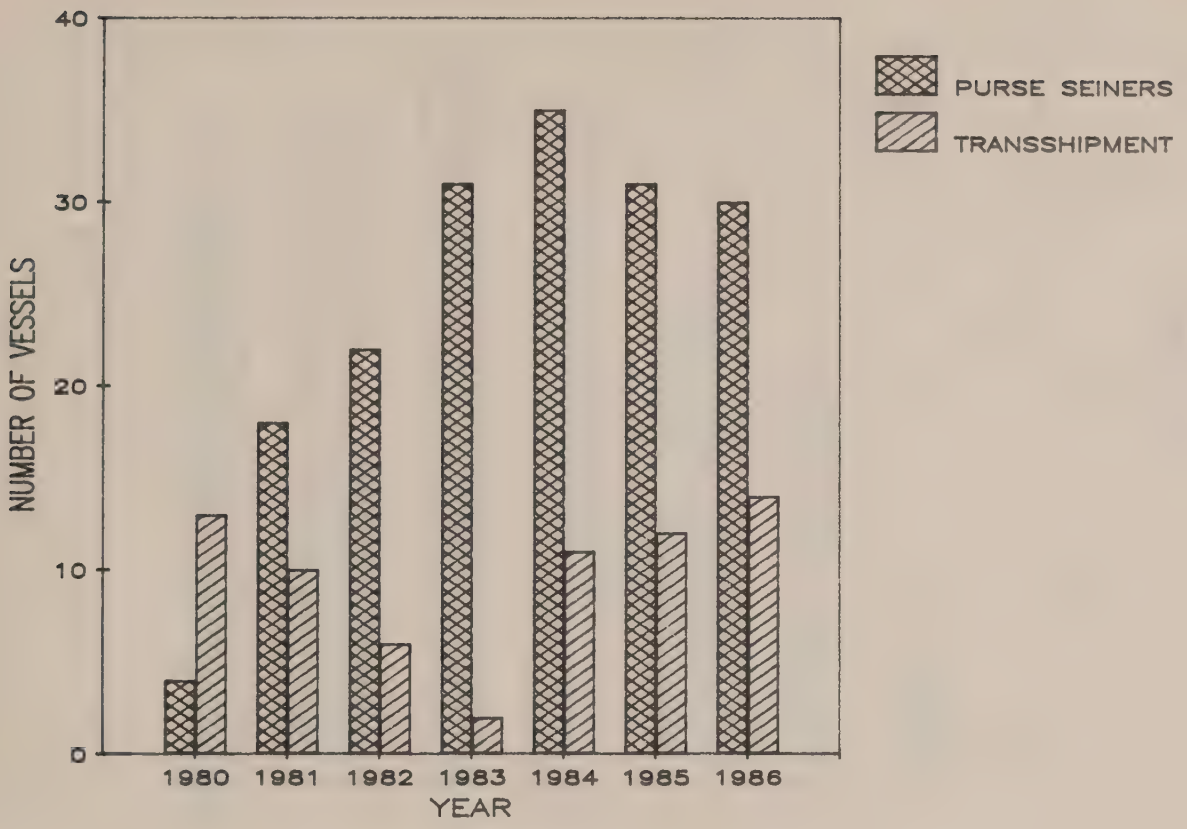


Figure 2.--Number of vessels of U.S. purse seiners and transshipment vessels off-loading in American Samoa, 1980-86.

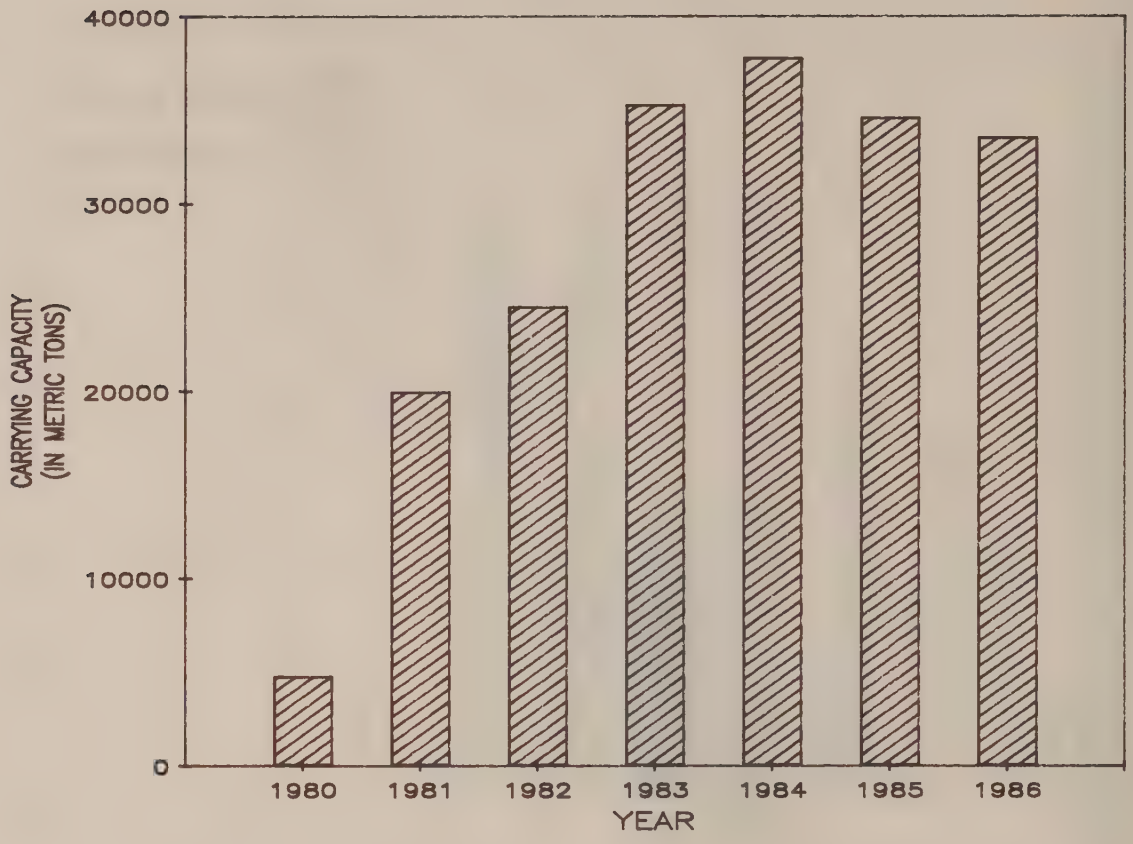


Figure 3.--Total carrying capacity of U.S. purse seiners off-loading in American Samoa, 1980-86.

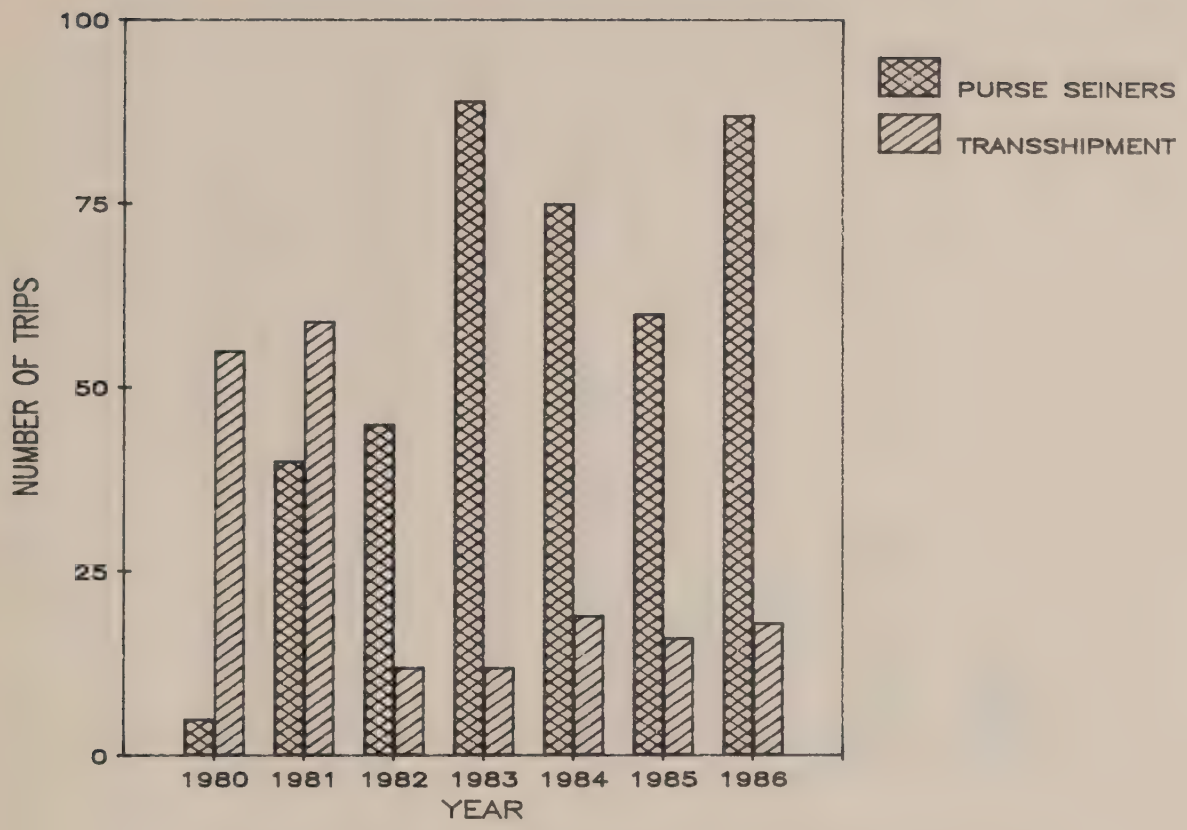


Figure 4.--Number of trips made by U.S. purse seiners and transshipment vessels off-loading in American Samoa, 1980-86.

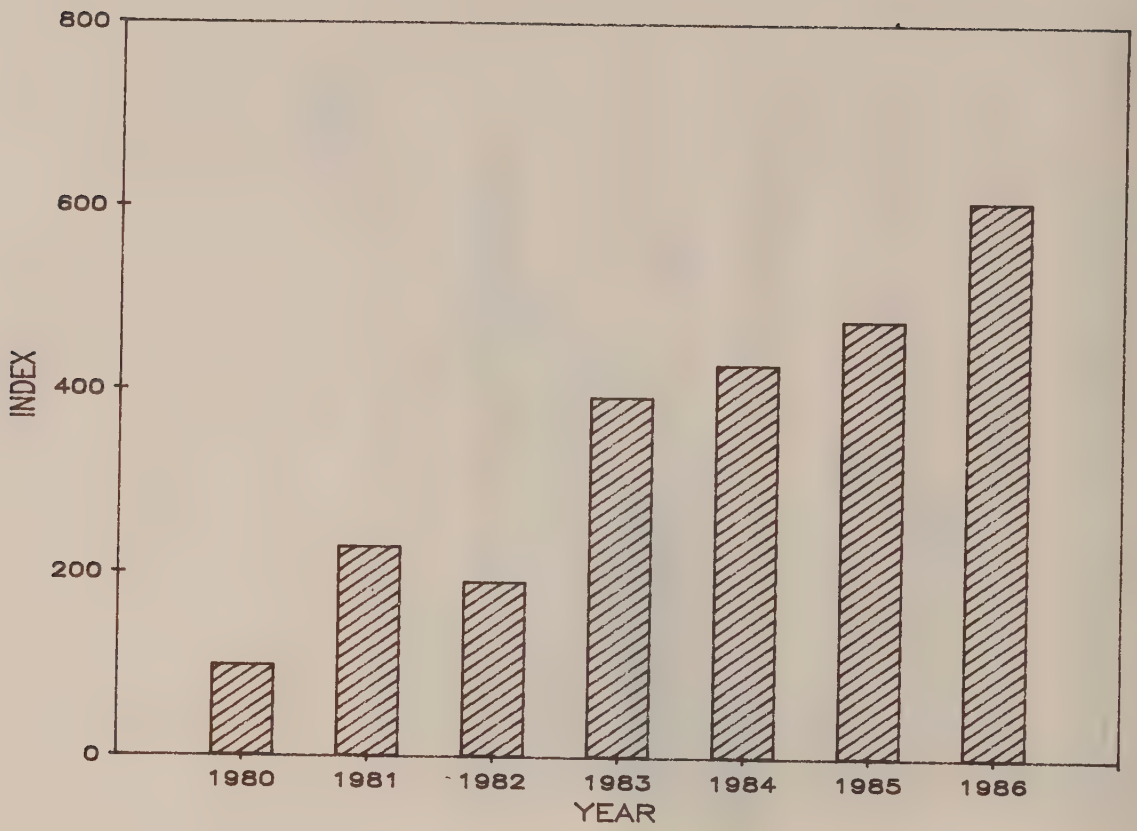


Figure 5.--Index of total landings (1980 = 100), 1980-86.

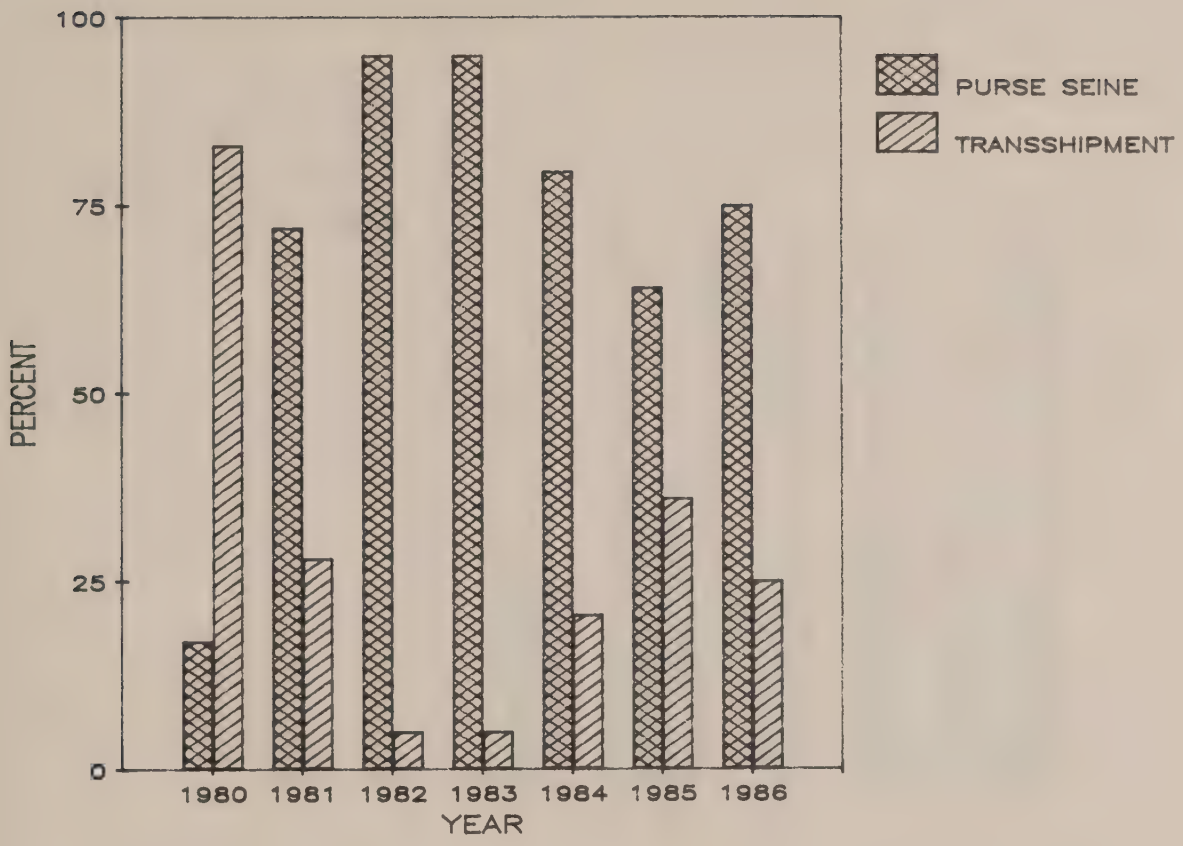


Figure 6.--Percent of catch off-loaded by purse seine and transshipment vessels, 1980-86.

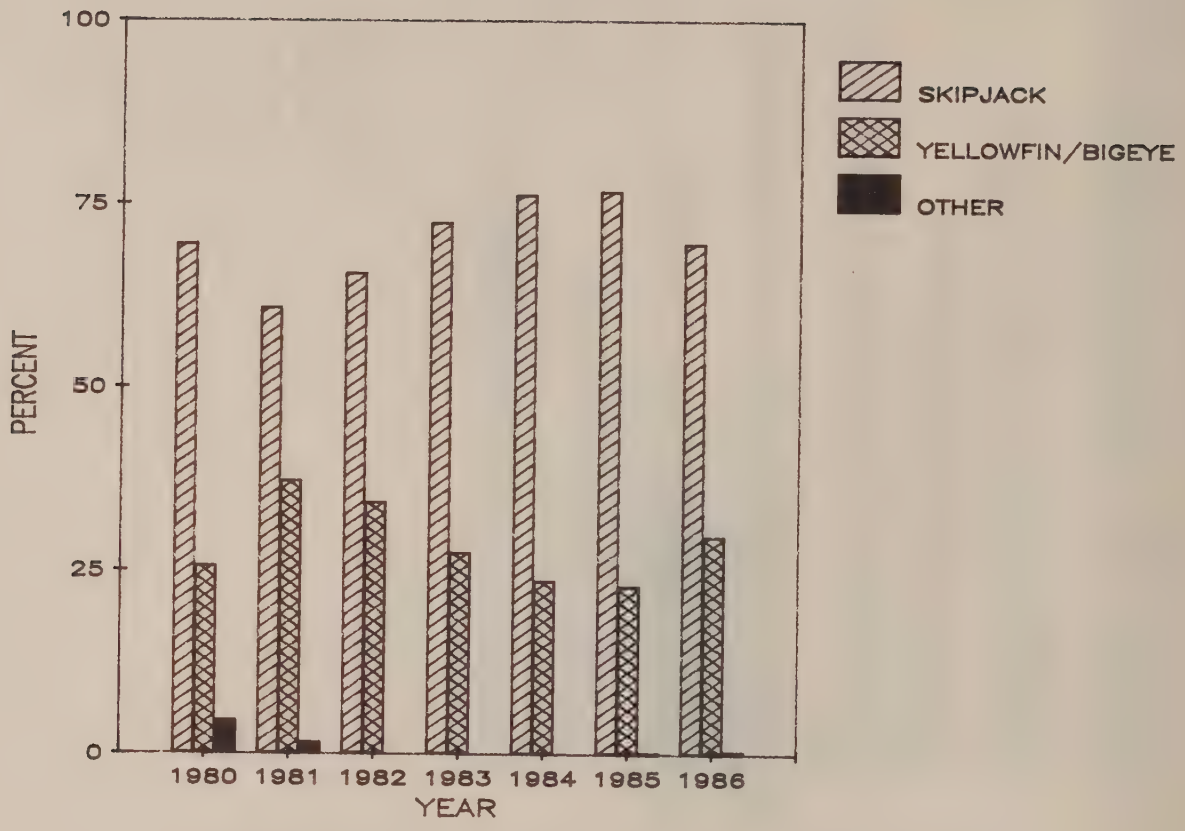


Figure 7.--Species composition of landings, 1980-86.

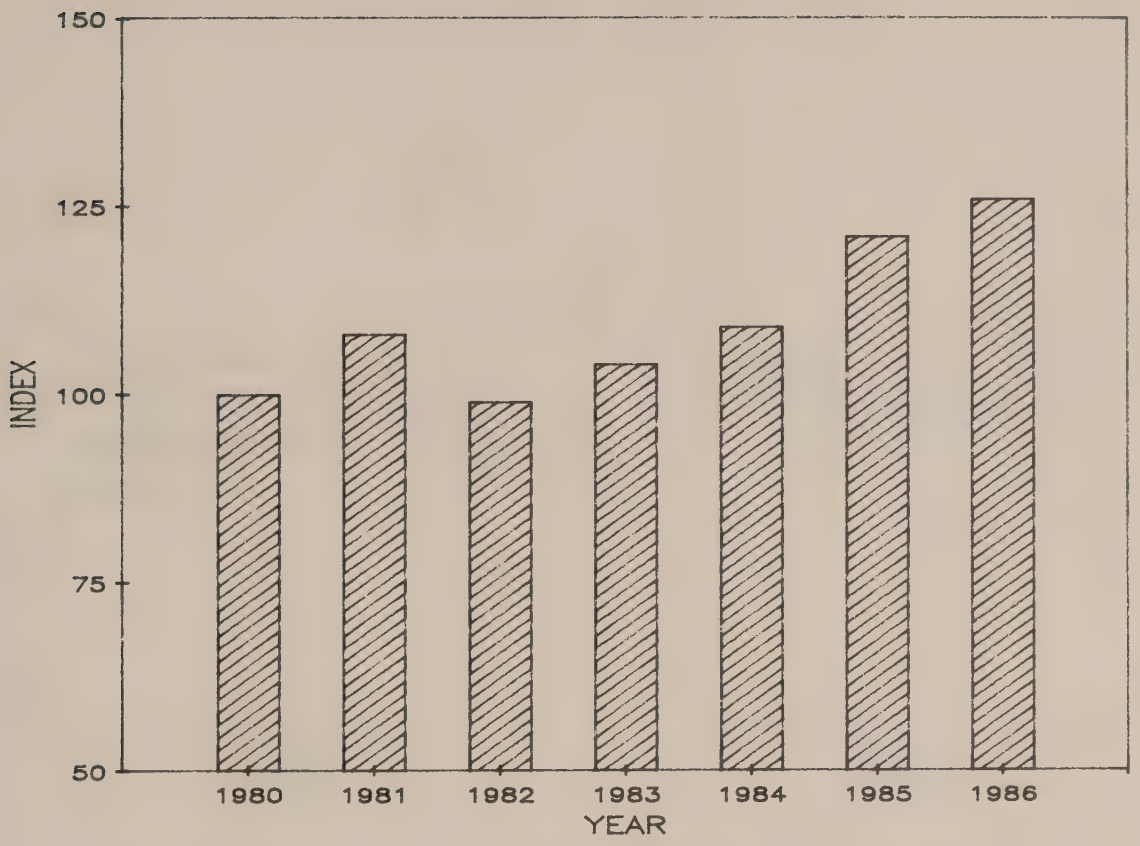
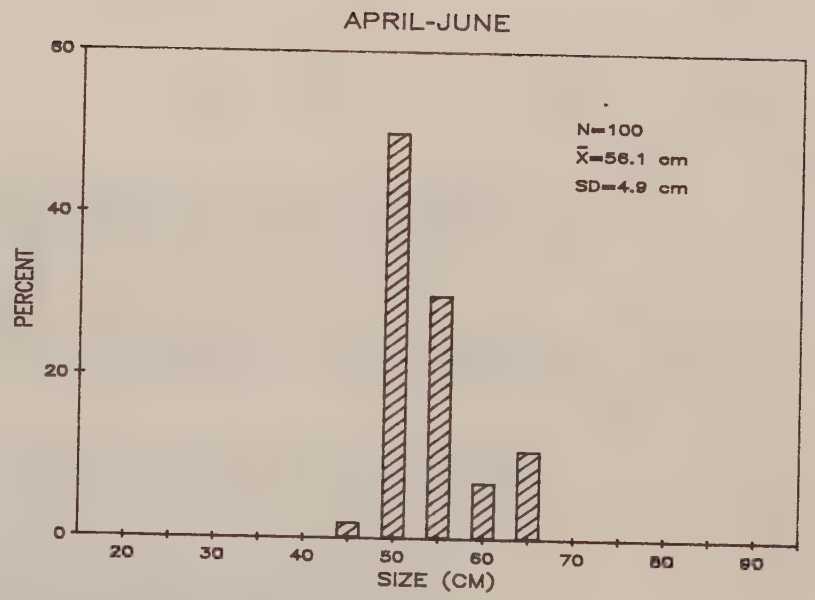


Figure 8.--Index of average catch per trip (1980 = 100), 1980-86.

JANUARY-MARCH
NO DATA



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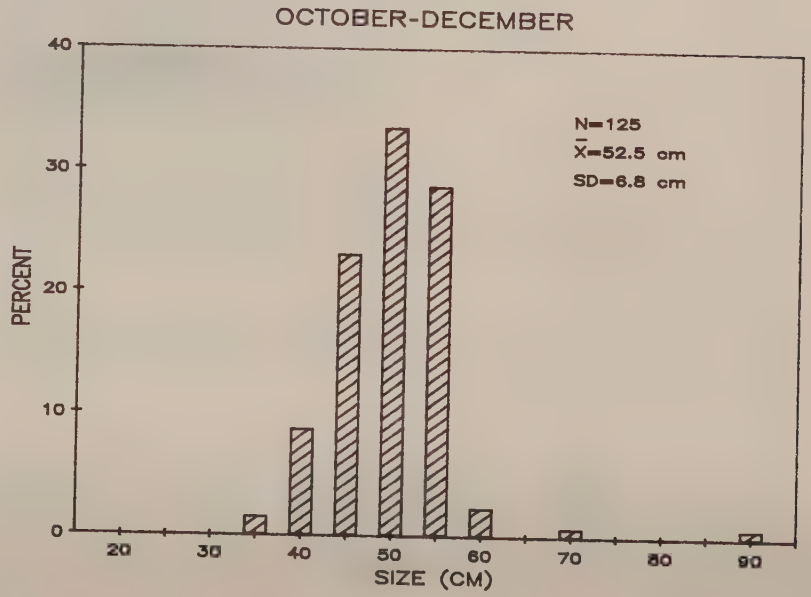


Figure 9.--Length frequency of purse seine caught skipjack tuna in 3-month intervals, 1981.

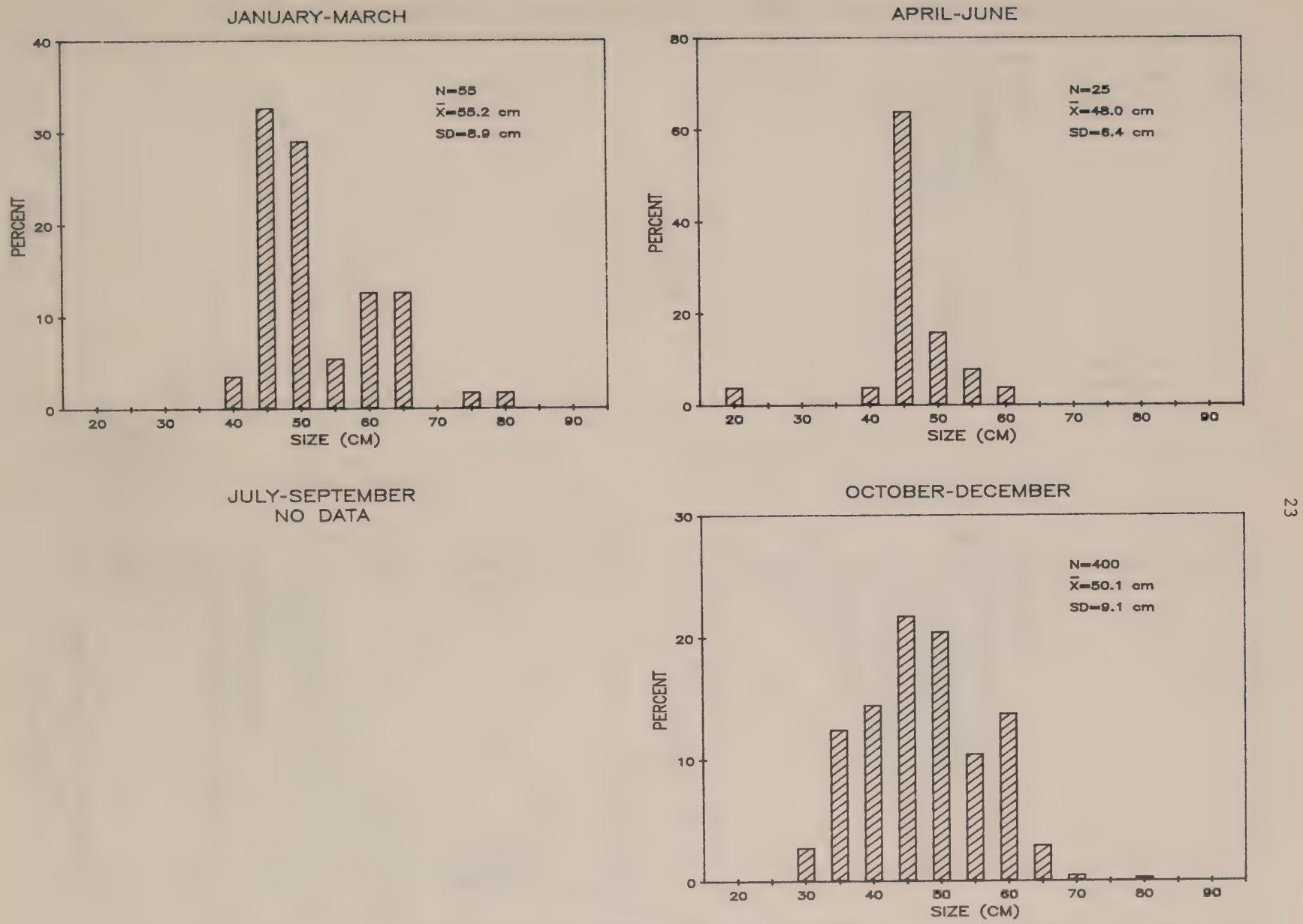
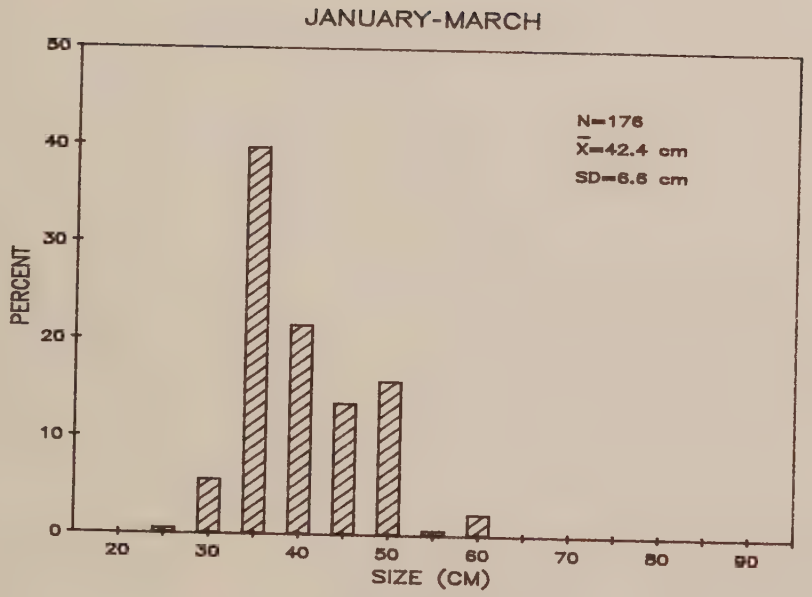
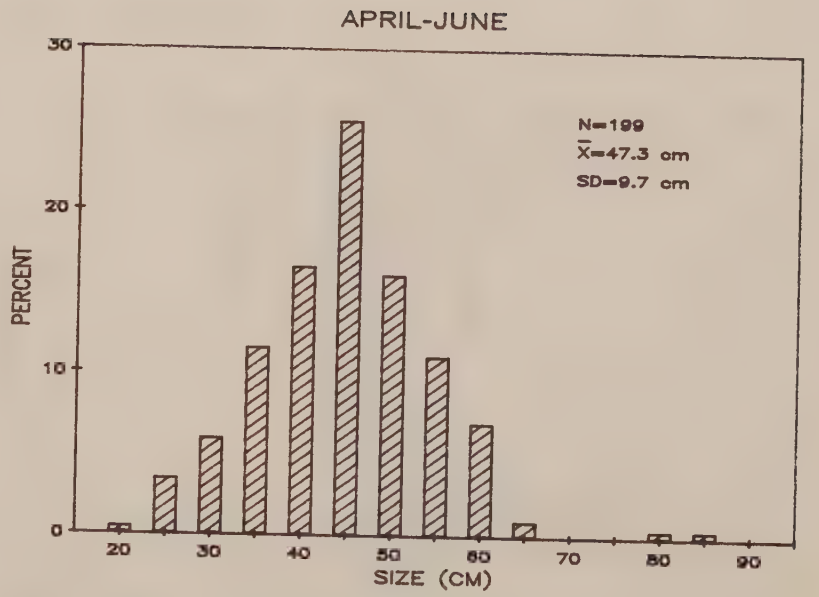


Figure 10.--Length frequency of purse seine caught skipjack tuna in 3-month intervals, 1982.





JULY-SEPTEMBER
NO DATA

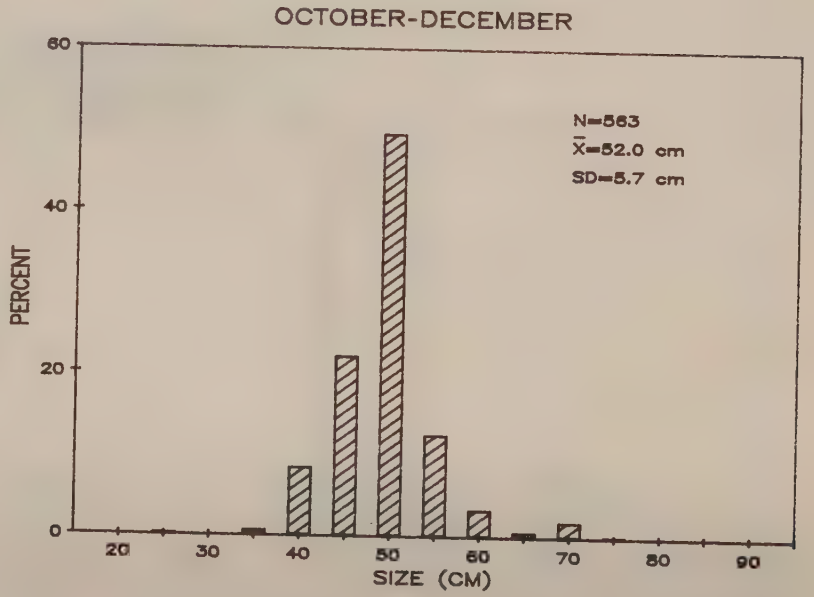


Figure 11.--Length frequency of purse seine caught skipjack tuna in 3-month intervals, 1983.

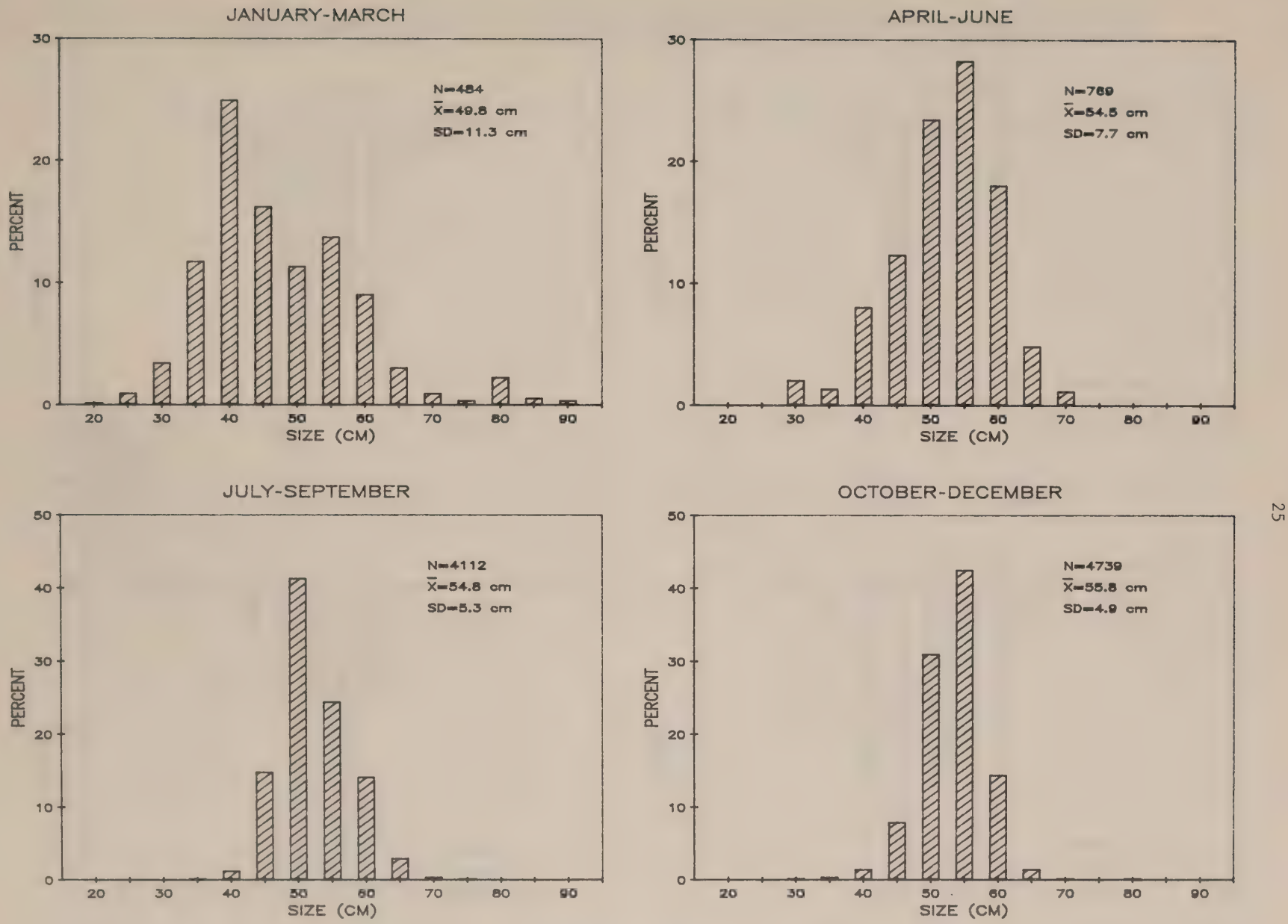


Figure 12.--Length frequency of purse seine caught skipjack tuna in 3-month intervals, 1984.

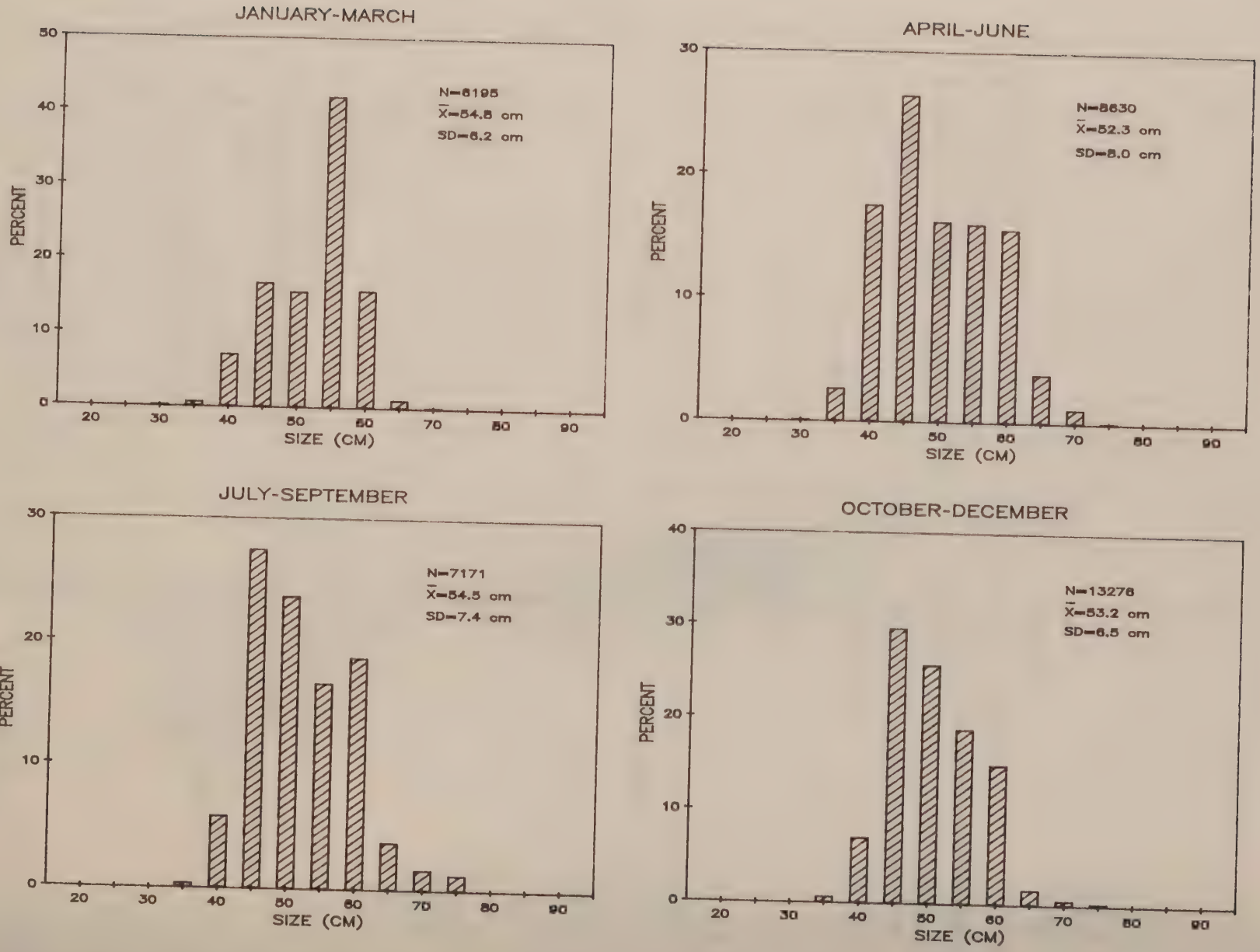


Figure 13.--Length frequency of purse seine caught skipjack tuna in 3-month intervals, 1985.

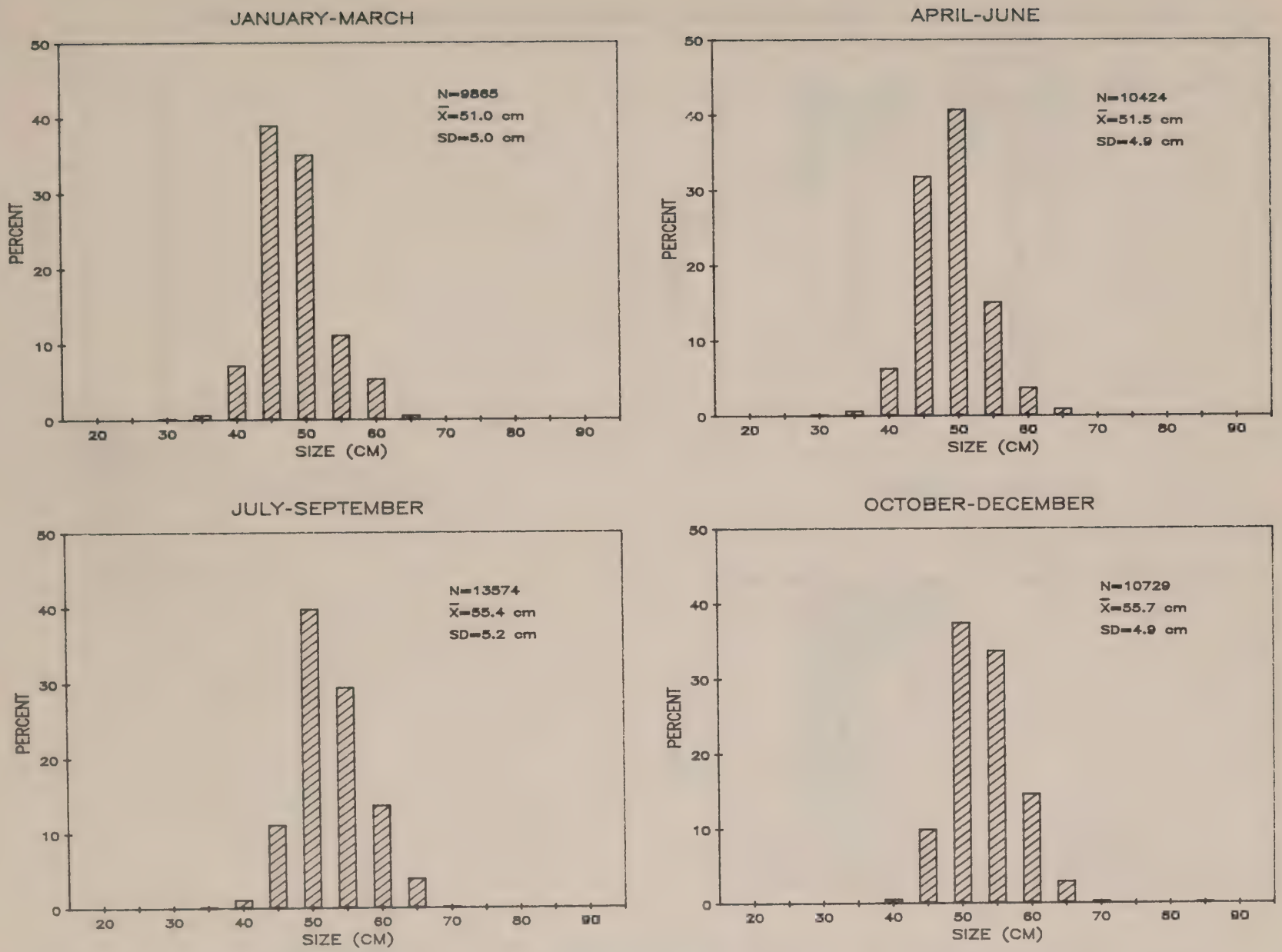
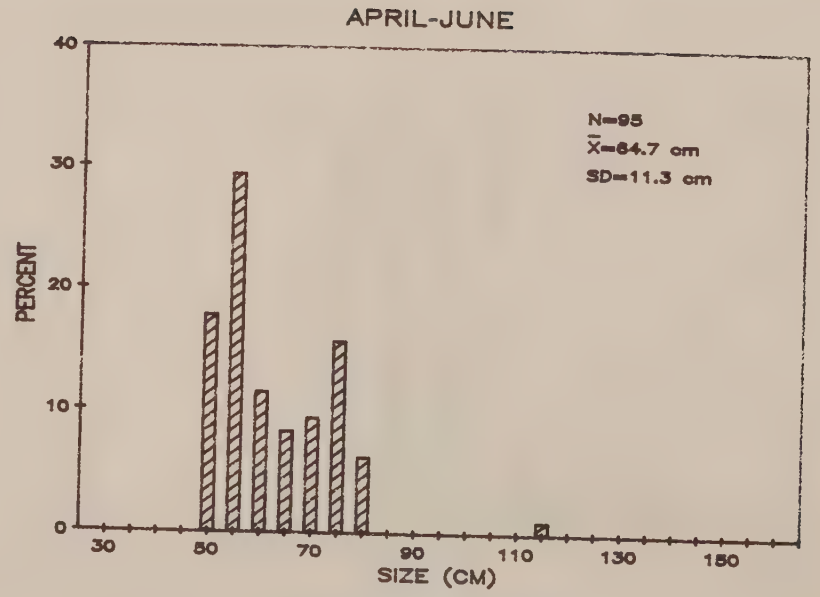


Figure 14.--Length frequency of purse seine caught skipjack tuna in 3-month intervals, 1986.

JANUARY-MARCH
NO DATA



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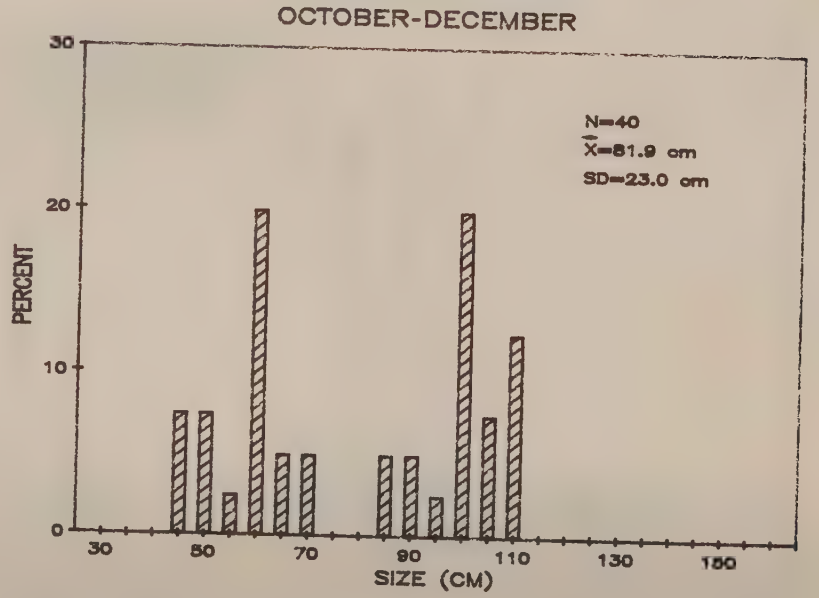

Figure 15.--Length frequency of purse seine caught yellowfin tuna in 3-month intervals, 1981.

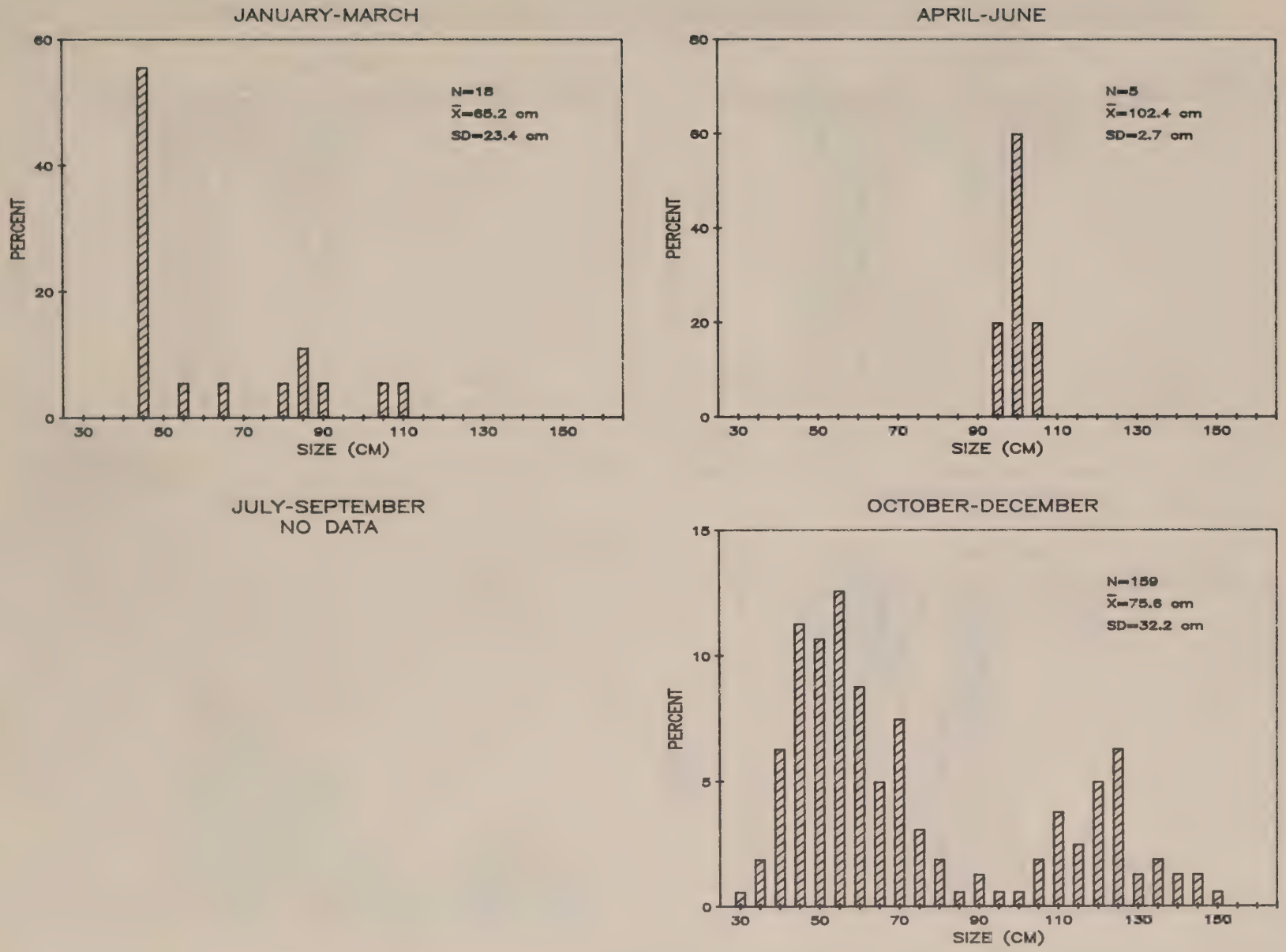

Figure 16.--Length frequency of purse seine caught yellowfin tuna in 3-month intervals, 1982.

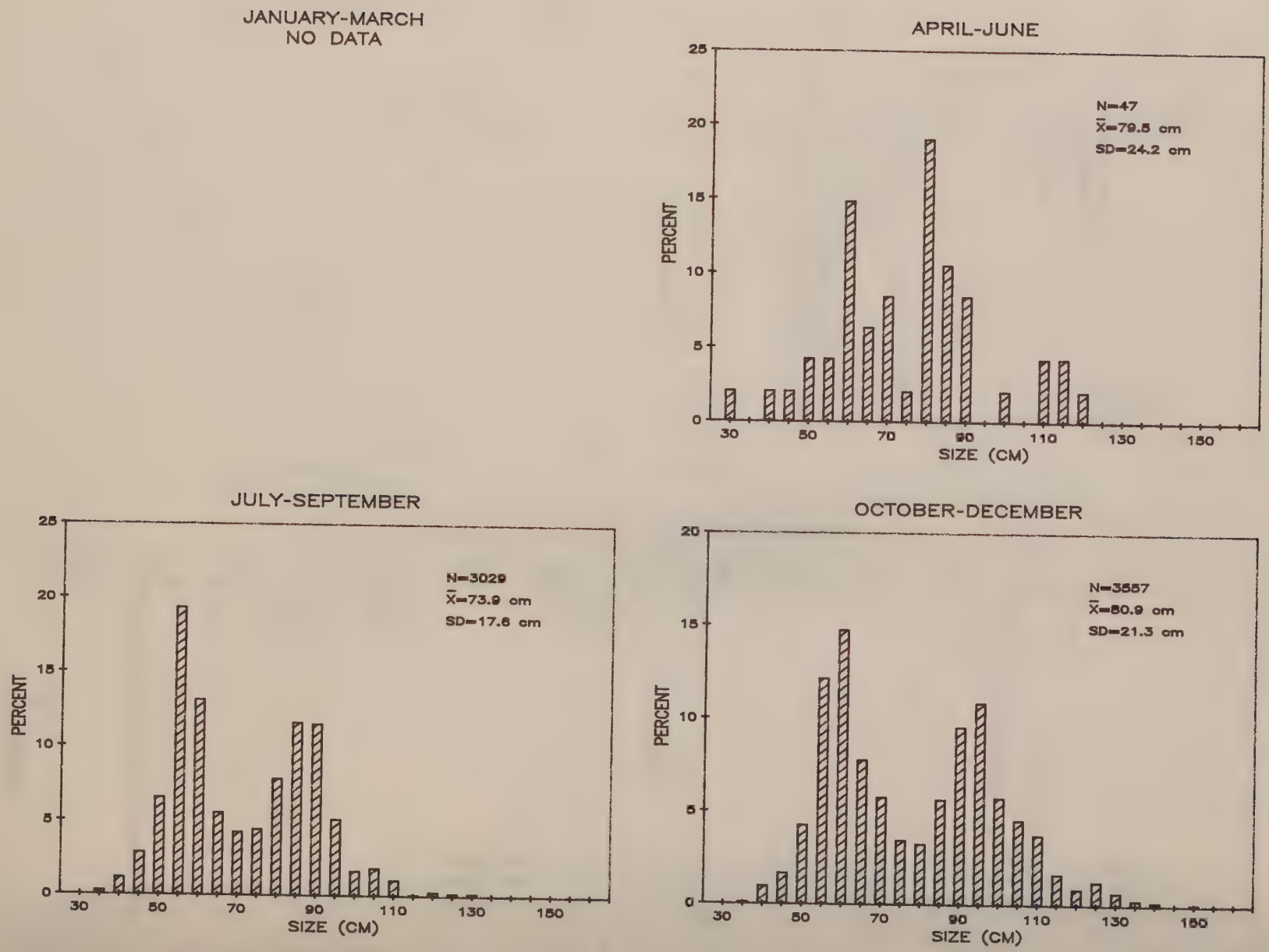

Figure 17.--Length frequency of purse seine caught yellowfin tuna in 3-month intervals, 1984.

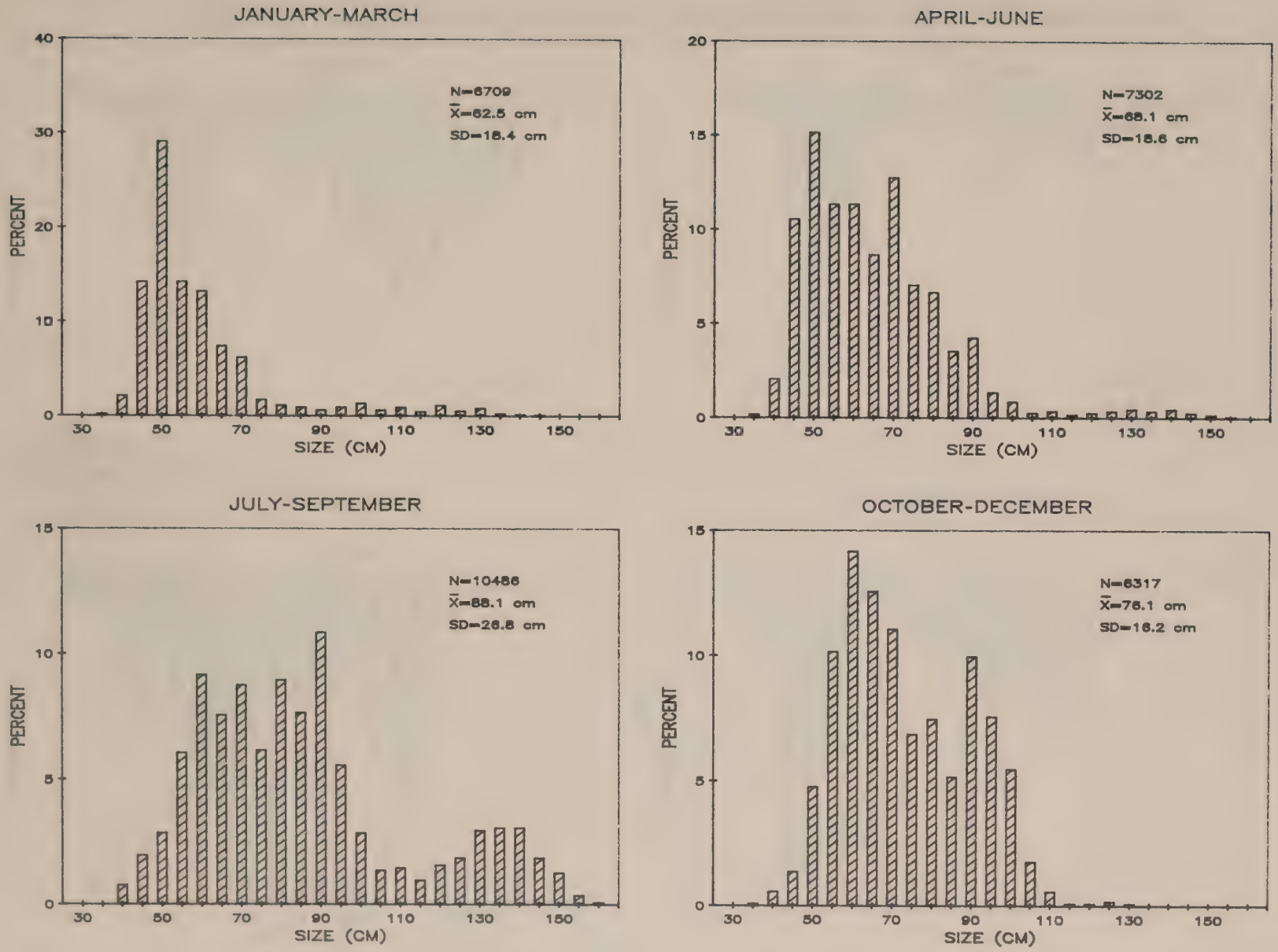

Figure 18.--Length frequency of purse seine caught yellowfin tuna in 3-month intervals, 1985.

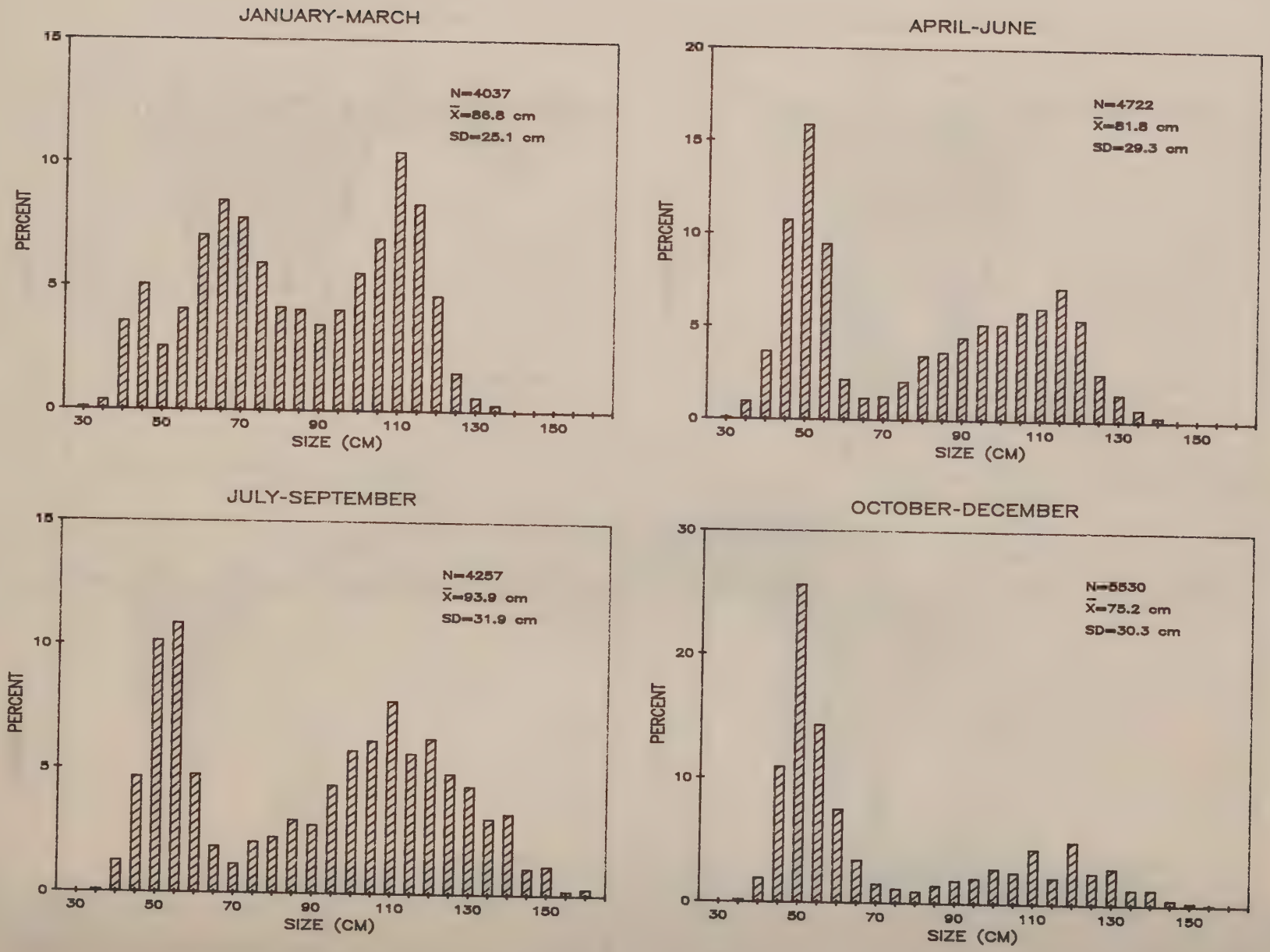

Figure 19.--Length frequency of purse seine caught yellowfin tuna in 3-month intervals, 1986.

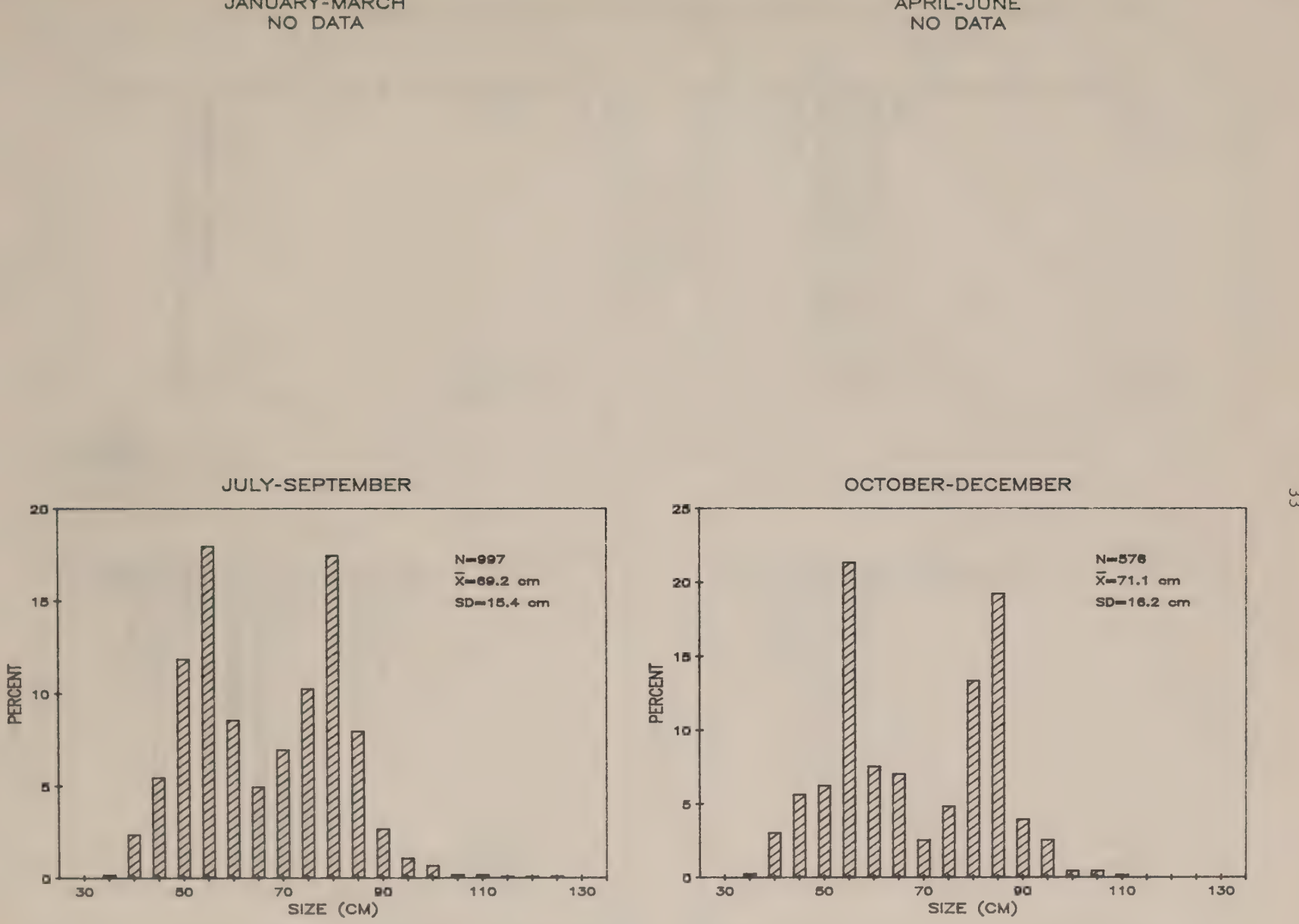

Figure 20.--Length frequency of purse seine caught bigeye tuna in 3-month intervals, 1984.

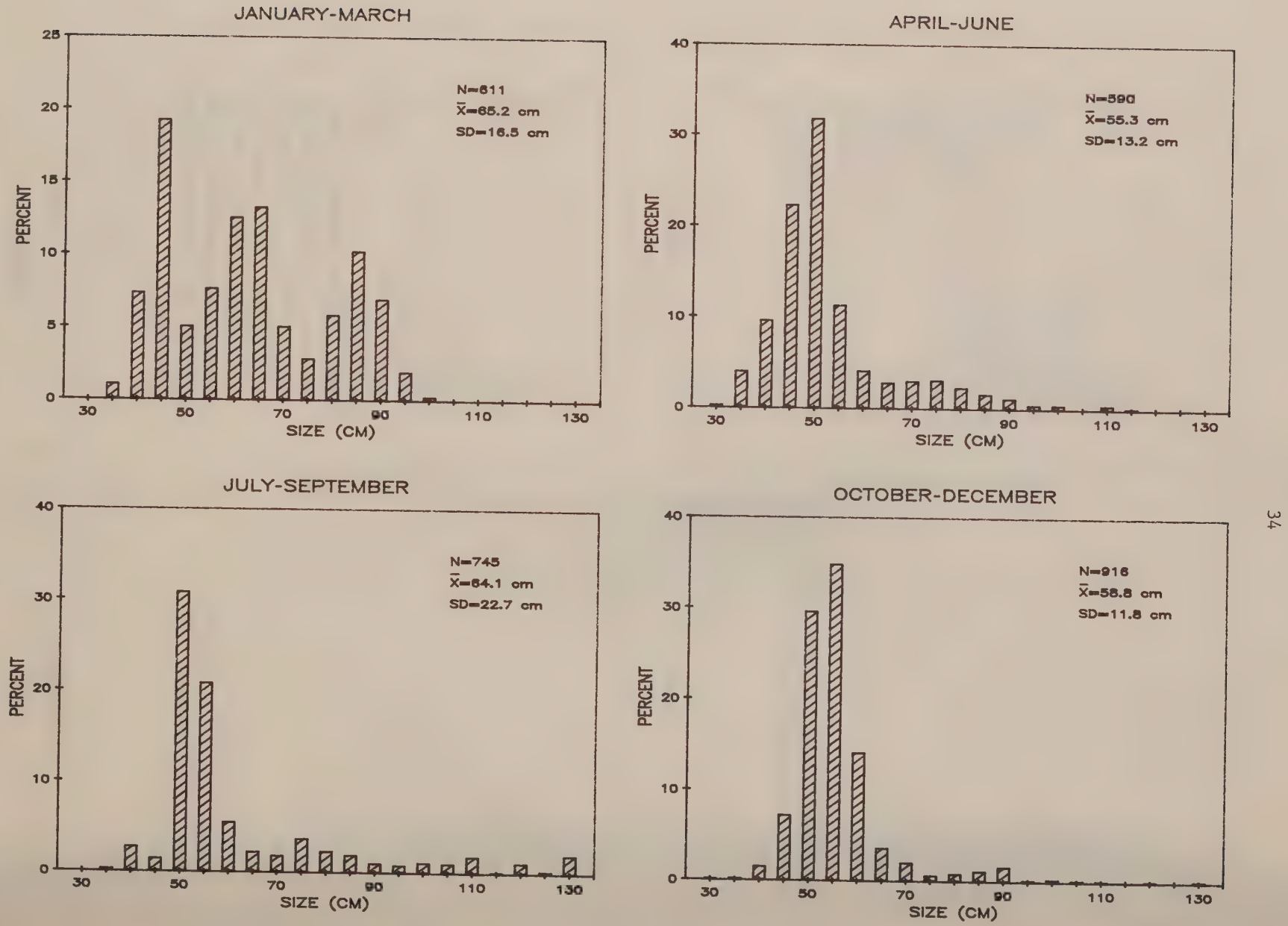

Figure 21.--Length frequency of purse seine caught bigeye tuna in 3-month intervals, 1985.

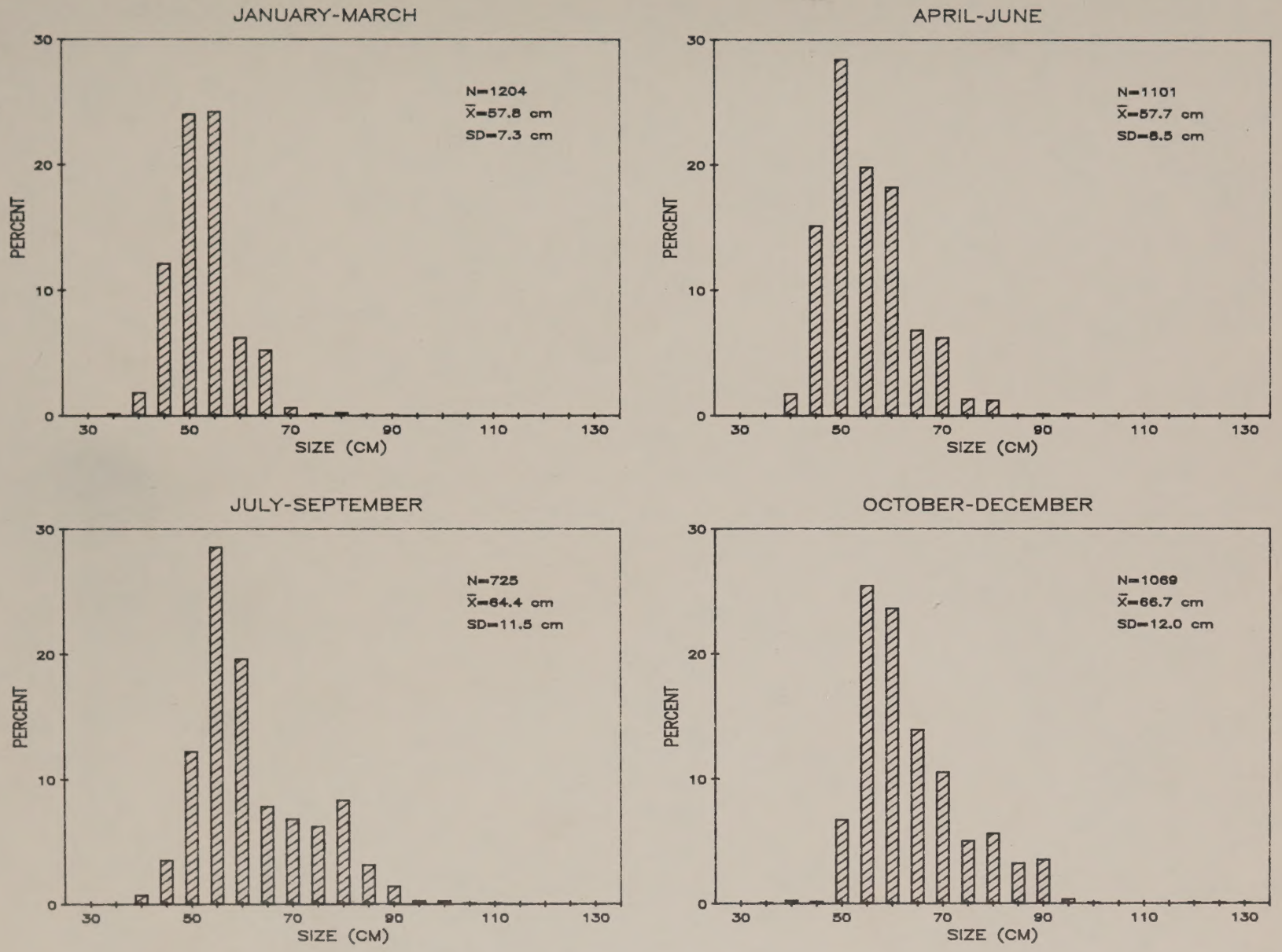

Figure 22.--Length frequency of purse seine caught bigeye tuna in 3-month intervals, 1986.